

CLAIMS

What is claimed is:

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1. A multi-layer polymer comprising

(1) a first outer layer,

(2) a second outer layer and

(3) an adhesive tie layer between the two outer layers,

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wherein the first outer layer comprises a polar polymer, the second outer layer comprises a non-polar polymer, and the adhesive tie layer comprises (a) a copolyester elastomer that is totally or partially miscible with the polar

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polymer, (b) a non-polar polymer that is totally or partially miscible with the non-polar polymer in the second outer layer and (c) a copolymer that contains functional groups capable of reaction with the functional end groups of component (a) and that is totally or partially miscible with the non-polar polymer in the second outer layer.

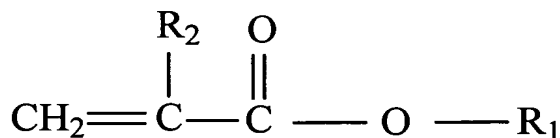
2. The multi-layer polymer of claim 1 wherein component (c) of the adhesive tie layer comprises an ethylene copolymer of the formula

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E/X/Y, wherein

E is the radical formed from ethylene and comprises about 40-90 weight % of the ethylene copolymer

X is the radical formed from



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wherein R₁ is an alkyl group with 1-8 carbon atoms,

R₂ is selected from the group consisting of H, CH₃, or C₂H₅, and X

comprises about 0-40 weight percent of the ethylene copolymer and

Y is selected from the group consisting of glycidyl methacrylate and

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glycidyl acrylate, and Y comprises 0.1-20 weight percent of the ethylene copolymer.

3. The multi-layer polymer of claim 1 wherein component (c) of the adhesive tie layer comprises an ethylene copolymer of the formula E/X/Y, wherein

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E is the radical formed from ethylene and comprises about 40-90 weight % of the ethylene copolymer

X is vinyl acetate and X comprises about 0-40 weight percent of the ethylene copolymer, and

Y is selected from the group consisting of glycidyl methacrylate and glycidyl acrylate, and Y comprises 0.1-20 weight percent of the ethylene copolymer.

4. The multi-layer polymer of claim 1 wherein the adhesive tie layer comprises about 25-65% by weight component (a), about 0-65% by weight component (b) and about 10-50% by weight component (c), wherein all percentages are based on the total weight of the adhesive tie layer.
5. The multi-layer polymer of claim 1 wherein the adhesive tie layer comprises about 25-65% component (a), about 25-65% by weight component (b) and about 10-50% by weight component (c), wherein all percentages are based on the total weight of the adhesive tie layer.
6. The multi-layer polymer of claim 1 wherein the first outer layer comprises a polar polymer selected from the group consisting of: polyvinylchloride homopolymer and copolymers, acrylonitrile-butadiene-styrene (ABS), polyvinylidene dichloride (PVDC), poly(ethylene terephthalate) (PET) homopolymer or copolymers, polyamides, polycarbonate, ethylene vinyl alcohol homopolymer and copolymers, acid copolymers, ionomers, liquid crystalline polymers, polyacetals, acetal copolymers, and polylactic acid.
7. The multi-layer polymer of claim 1 wherein the second outer layer comprises a non-polar polymer selected from the group consisting of: polypropylene homopolymer and copolymers, and polyethylene homopolymer and copolymers.
8. The multi-layer article of claim 1 wherein the copolyester elastomer comprises a segmented thermoplastic ether-ester elastomer, and further wherein the soft segments comprise polytetramethylene glycol (PTMEG) and the shore D hardness of the elastomer is about 55 or less.
9. The multi-layer polymer of claim 1 wherein the E/X/Y copolymer is selected from the group consisting of copolymers of: ethylene-n-butyl acrylate- glycidyl methacrylate (EnBAGMA), ethylene – butyl acrylate – glycidyl methacrylate (EBAGMA), ethylene-glycidyl methacrylate (EGMA), ethylene-methyl acrylate-glycidyl methacrylate (EMAGMA), ethylene –ethyl acrylate-glycidyl methacrylate (EEAGMA), ethylene –

propyl acrylate – glycidyl methacrylate (EPAGMA), and ethylene - vinyl acetate - glycidyl methacrylate (EVAGMA).

- 5 10. The multi-layer polymer of claim 1 wherein the first outer layer comprises PVC and the second outer layer comprises polypropylene homopolymer.
- 10 11. The multi-layer polymer of claim 10 wherein the adhesive tie layer comprises about 25-65% by weight of a copolyester elastomer comprising a segmented thermoplastic ether-ester elastomer having soft segments comprising polytetramethylene glycol (PTMEG) and a shore D hardness of about 55 or less, about 10-50% by weight polypropylene, and about 25-65% by weight EnBAGMA, wherein all weight percentages are based on the total weight of the adhesive tie layer.
- 15 12. The multi-layer polymer of claim 11 wherein the multi-layer polymer demonstrates a peel strength as tested using ASTM # D903-98 greater than about 5 psi/in width (0.09 kg/mm width).
- 20 13. Exterior siding for buildings comprising the multi-layer polymer of claim 11.
- 20 14. The exterior siding of claim 13 wherein the first outer layer of PVC comprises the exterior surface of the siding.
- 25 15. An article comprising the multi-layer polymer of claim 11 wherein the article is selected from the group consisting of: construction materials, automobile interior parts, and toys.
- 25 16. The multi-layer polymer of claim 11 wherein the polymer was made by a process selected from the group consisting of: coextrusion and lamination.
- 30 17. The multi-layer polymer of claim 1 wherein component (c) comprises an acid copolymer or anhydride derived from an acid copolymer.
- 30 18. The multi-layer polymer of claim 17 wherein component (c) comprises maleic-anhydride-grafted polypropylene.
- 35 19. A process for making a multi-layer polymer comprising the step of coextruding the following layers to form a multi-layer polymer:
- 35 (1) a first outer layer,
- 35 (2) a second outer layer and
- 35 (3) an adhesive tie layer between the two outer layers,
- wherein the first outer layer comprises a polar polymer, the second outer layer comprises a non-polar polymer, and the adhesive tie layer comprises

- 5 (a) a copolyester elastomer that is totally or partially miscible with the polar polymer, (b) a non-polar polymer that is totally or partially miscible with the non-polar polymer in the second outer layer and (c) a copolymer that contains functional groups capable of reaction with the functional end groups of component (a) and that is totally or partially miscible with the non-polar polymer in the second outer layer.
- 10 20. The process of claim 19 wherein the first outer layer comprises PVC, the second outer layer comprises polypropylene homopolymer, and the adhesive tie layer comprises about 25-65% by weight of a copolyester elastomer comprising a segmented thermoplastic ether-ester elastomer having soft segments comprising polytetramethylene glycol (PTMEG) and a shore D hardness of about 55 or less, about 10-50% by weight polypropylene, and about 25-65% by weight EnBAGMA, wherein all
- 15 weight percentages are based on the total weight of the adhesive tie layer.
21. A process for making a multi-layer polymer comprising the step of laminating:
- 20 (1) a first outer layer,
(2) a second outer layer and
(3) an adhesive tie layer between the two outer layers,
under sufficient heat and pressure to fuse the layers and form a multi-layer polymer,
wherein the first outer layer comprises a polar polymer, the second outer
- 25 layer comprises a non-polar polymer, and the adhesive tie layer comprises (a) a copolyester elastomer that is totally or partially miscible with the polar polymer, (b) a non-polar polymer that is totally or partially miscible with the non-polar polymer in the second outer layer and (c) a copolymer that contains functional groups capable of reaction with the functional
- 30 end groups of component (a) and that is totally or partially miscible with the non-polar polymer in the second outer layer.
- 35 22. The process of claim 21 wherein the first outer layer comprises PVC, the second outer layer comprises polypropylene homopolymer, and the adhesive tie layer comprises about 25-65% by weight of a copolyester elastomer comprising a segmented thermoplastic ether-ester elastomer having soft segments comprising polytetramethylene glycol (PTMEG) and a shore D hardness of about 55 or less, about 10-50% by weight polypropylene, and about 25-65% by weight EnBAGMA, wherein all

weight percentages are based on the total weight of the adhesive tie layer.